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Post-War International Trade

The foundry industry has been well represented on the International Trade Policy Committee of the Federation of British Industries, which body has just issued its findings, and it can thus be assumed that the Report covers the import of the raw materials and the export of finished products of the industry. As would be expected, the Report is orthodox and nothing revolutionary, as suggested. World prosperity follows closely on the heels of national prosperity and mondial co-operation is sought to bring about this desirable end. How essential this is, is illustrated by the economic chaos which followed the absence of Russian participation in the world's markets; the filling of gaps so caused from other sources, and the final return of that country to the place previously occupied. The Committee supports the recent "Proposals for an International Clearing Union," issued by the British Treasury, rather than the "United and Associated Nations' Stabilisation Fund" submitted by the American Treasury. This decision will not be viewed by the South African Government with enthusiasm, as the jewellery trade will not normally be able to absorb the production of the Rand. However, the great expansion of engineering in the Dominion during the war will render the Dominion less dependent on the mining industry than has been the case in the past. The main objective to keep in mind by all nations is "full employment." Under the heading "Investment Aid," an international policy of long-term investment in those countries most in need of development is supported. What is the attitude to adopt in the next stage? A few millions invested in a large-scale iron and steel industry for, say, South America, would, if successful, tend to balance the local economy in respect to agriculture, provide invisible exports for the overseas investors, and reduce imports. Presumably, if this action causes full employment in any economic unit, it is permissible, and the countries habitually exporting iron and steel products must replace the lost exports by other goods. Yet, with a well-developed iron industry, most other finished products become possible, as the manufacture of machinery is a natural consequence. Thus, in course of time, the mineral and agricultural resources will take precedence over reserves of industrial skill, as the latter are mobile. Some line of reasoning akin to this must have animated the Committee, as they state: "The future will bring great industrialisation throughout the world. British industrial activity may well increase, but its nature will change and the process of change will entail adjustments" and "an International Economic Council should guide world trade to channels where it would most benefit consumer and producer." From this angle, then, where purely agricultural communities are *fully employed*, industrialisation should be discouraged, providing a reasonable standard of living is being experienced. The Committee supports the grouping of the smaller nations into economic units to promote trade between the group and the rest of the world. This arrangement, having in mind the Little Entente, the Oslo and Ouchy Conventions, the Danubian Pact and other pre-war efforts at grouping, would mean the scrapping of the existing "most-favoured nation" clauses in a number of international tariff agreements. The F.B.I. Committee has encountered exactly the same difficulties over "fashions" as did the British Ironfounders' Association with trade-marked goods in pre-war days. Whilst it was possible to arrange for the orderly marketing of rainwater goods, design and finish operated against the same treatment for stoves and cookers. The only advice tendered by the Committee and from which we would expect no lasting benefit is, "In-

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CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

CUPOLA OPERATION

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I have just read with the greatest of interest your reprint of Mr. R. C. Tucker's Paper, "Cupola Operation and Control." During the past year I have assisted in experiments concerning air/coke ratios, and the best way of feeding air to the coke. These experiments are not yet completed, but already it has been possible definitely to confirm many of the points made by Mr. Tucker, particularly in regard to tuyere shapes, dimensions and distribution; and the path taken by the air after leaving the tuyeres.

These experiments have depended in an important degree on extremely accurate measurement of the air velocities, stream directions, and volumes. It is on this point that I should like to take up Mr. Tucker's depreciation of the reliability of air measuring instruments.

It would seem that Mr. Tucker has "suffered" from some of the impositions (there is no other word) foisted on the foundry industry during past years. But while the practice of offering such inaccurate measuring devices is to be deplored, the foundryman cannot escape criticism entirely. He is usually very particular about his sources of supply of such materials as coke, iron, refractories, etc., yet often hesitates to instal meters of a reputable origin "because of their heavy cost."

Yours, etc.,
H. A. HALLETT
(Managing director, Metronic Instrument Company, Limited).

196, Grove Lane, Smethwick 40, Staffs.
February 18, 1944.

[This letter has been abridged somewhat.—EDITOR.]

CORE-MIXING MACHINES

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—In an article which has appeared in THE FOUNDRY TRADE JOURNAL, "Notes on Oil Sand Practice in the Ordinary Foundry," by Mr. W. Y. Buchanan, we notice in the issue of January 6, 1944, that reference is made to the Rotoil Mixer, of which we are the Patentees and manufacturers, and we think that the author's remarks on page 11 may give an impression that the firm responsible for the design and production of Rotoil Mixers has superseded these with another type. This is not the case, and the manufacture of Rotoils has not been interrupted, but they are not now marketed by the firm who were previously distributing them. The special patented features of the Rotoil remain exclusive to our machines.

We do not wish in this letter to take up points relative to mixing efficiency and maintenance costs to which the author refers, although it might be pointed out that the graphs prepared by him, showing ultimate strength figures, do not support the impression which we think his text may convey. We certainly find it difficult to visualise practical conditions where only two batches of oil-sand are dealt with in a Rotoil in 50 minutes, as these machines operate rapidly, and extensive experience has proved the cost of maintenance to be extremely low.

Yours, etc.,
For C. & B. SMITH, LIMITED.
H. R. HARPER,
Secretary.

C. & B. Smith, Limited,
Stewart Street, Wolverhampton.
February 21, 1944.

INDUSTRIAL PUBLICITY

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—With reference to the broadcast on "The Steel Industry in Wartime," by Dr. Desch, on February 29, this would appear to be preferential treatment of the steel industry by the B.B.C. Let us have a broadcast on the foundry industry also, and we shall be satisfied. Castings are also playing their part in helping to win this war.

Yours, etc.,
W. T. BRUCE.

7, Heathfield Avenue,
Chesterfield.
February 21, 1944.

POST-WAR INTERNATIONAL TRADE

(*Continued from page* 173.)

dustries should examine this problem to see if it is possible or desirable to negotiate international agreements with similar industries in other countries. The proposed International Economic Council should be entrusted with the task of co-ordination and of ensuring that these arrangements operate in the common interest." The mass production of a gas or electric cooker for a given market is rightly regarded as a sort of industrial masterpiece by any enterprising concern, and its entry into a common classification is not welcomed. That is why it is trade marked and money spent on its popularisation. On the subject of imports, we gather that a desire is expressed that a quota should be assigned, within a system of general rigid control, wherein miscellaneous material can be had. The general notions put forward will be endorsed by most manufacturers, as well as the increased flexibility and speed expected from any future Imports Advisory Committee, as such attributes are essential for industrial planning. Beyond placing, perhaps, too much reliance on international committees, the Report gives a picture of what will happen after the cessation of hostilities.

A SMALL MOULDING UNIT

By A. WOOD

This article shows the jobbing foundry the way to start mass production on sensible lines

As well as being small, the unit illustrated in Fig. 1 is simple. Moreover, there is nothing elaborate about the layout or method. It has, however, proved so successful in operation that it is felt that it will be of general interest.

The layout shown was planned with the utmost care so that the movement of operators is reduced to a minimum. There is the start of track which is in moderate range of the moulding machines, and also the return flasks are quite handy, the room between the two tracks being utilised for flask storage, pattern rack and cupboard. The bins are placed in the most favourable position for the labourer so that his carrying distance is also small, the return flask track being quite handy.

Moulding Machines Used

These machines are the ordinary type of Wallwork jolt squeeze, with a table size of 22 in. x 17 in., and fitted to take a flask size of 17 in. x 16 in. x 6 in., but can also take different sizes, depending on pattern marked for operation. The head of these machines can be set to the type of pattern so as to determine hardness of mould, therefore keeping each mould at the same density. On the squeezer board there is fitted a runner bush which is squeezed in the mould, ensuring a clean runner and also eliminating the use of bushes, which are generally put on by another operator, this being in itself a small saving of sand and manpower. There are different types of runner bushes (Fig. 3), each being designed for running purposes or easy pouring and to keep the back-scrap at its lowest.

There is a squeezer board to each pattern so that when the pattern is changed everything is to hand; there is no running round the foundry to find different parts of the job. The machines are fitted with Heatrae electric heaters which ensures a steady warmth of the pattern, therefore cutting out all searching for old oily waste or other material, with which to warm the pattern, causing a hold up or general stoppage of the unit. There may be perhaps a wood pattern in operation, then the fuses are taken out of the heaters, to prevent them being damaged.

The operators then use the dust bag, which is filled with the material best suited for the pattern in operation, chiefly bone dust or plumbago, sometimes a little coal dust being used. The patterns are changed at night, or if necessity arises, at lunch time. The machine repair men on setting up patterns make a mould before passing it as satisfactory. This gives a guarantee that machines are ready for moulding operators to commence immediately.

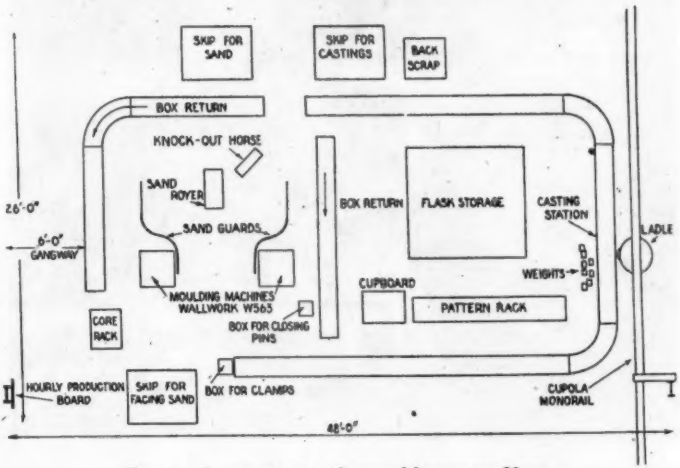

FIG. 1.—LAY-OUT OF A SMALL MOULDING UNIT.

Roller Track

On installing this unit several types of roller track were tried, until the one most suitable for the job was found, this being with 4 in. pitch, which allows a steady movement of the moulds. At the closing station where drag moulds are put on the track, cored up and then closed, there is 6 feet of horizontal track, 1 ft. 6 in. from ground level; this being done so that there is room for the drag machine to keep the operator coring up busy.

There is a slight slope of the track down to the pouring station which allows a steady movement of the mould without any aid of the operator. It is then

* A Paper presented to the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen. Mr. J. J. Sheehan presiding.

A Small Moulding Unit

more or less in position for casting (Fig. 4) pending a slight adjustment by the supervisor of castors.

After casting, the moulds are moved round to the knock out, there being a slight rise in track so that moulds are brought to a height quite accessible for the labourer to handle.

The track for the return is also on the gravity system, so that when empty flasks are put on they move steadily till they are in position for the machine operator. This is by the side of machine (Fig. 5), thereby cutting out all walking for flasks. It should be noted that at the pouring station the track is arranged to be 6 in. above ground level, thereby giving easy access for cleaning beneath the rollers.

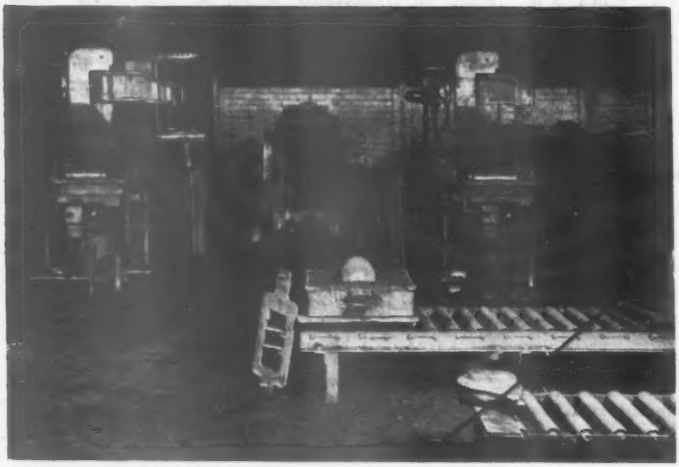

FIG. 2.—GENERAL VIEW OF THE MOULDING MACHINES.

Knock Out Station

The moulds after casting are taken round to the knock out station (Fig. 1), where bins on stillages are in place ready for the labourer. First of all he removes the heads from the moulds and places them into a handily placed bin. Then he gives a slight tap to down runner to loosen the casting from the cope mould. This done, everything is ready for the knock out process. The cope is lifted off, and with a very small distance to carry it, it is knocked out on what is called a knock out horse (Fig. 6), the sand falling through on to the floor. The empty flask is then put on return flask track, and with a slight push it goes back to the moulding operator. If the return track be full of empty flasks, boxes may be stacked on top of each other to a height within easy reach of the operator, and to a degree of safety.

The casting is then removed from the drag mould to another bin, the same process then taking place with drag mould as with the cope, the bottom board being returned with drag flask.

There is a Pneulec Royer sand preparing machine just in front of knock out horse so that the labourer can keep moulders supplied with prepared backing sand and also keep the space clear for knocking out (Fig. 5). When the stock of sand is too high, some is then taken away to the sand mill for reconditioning to facing sand. The sand removed is carefully selected, and when a heavy casting is being made, and therefore causing a large amount of burnt sand, such material is not incorporated. Again, if a casting is made with a series of cores, where in the knocking out process core wires and core sand get mixed with moulding sand, it is separated. By doing this the management are assured that only the best sand is retained on the unit for use as backing sand.

The heap sand is then put through the Pneulec Sand Royer, which is in a position so that the sand is delivered within easy reach of machine operators. There is a sand control board (Fig. 7) fixed nearby, and samples are taken every hour. Should any of the characteristics of the sand vary from a fixed standard, steps can be taken to remedy it in the shortest time.

Bottom Boards

Bottom boards being one of the main items on this unit need careful attention. One is shown in Fig. 8. After selection from several try-outs, this one was eventually put into service

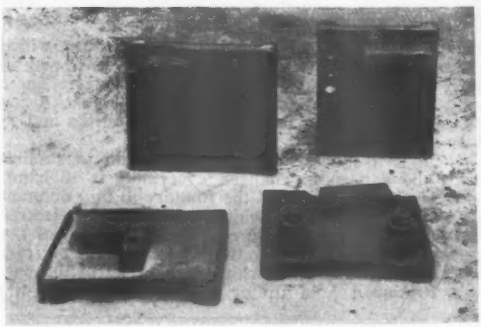

FIG. 3.—SHOWING THE SQUEEZER BOARDS FITTED WITH RUNNER BUSH PATTERNS.

from which very good results are given, there being a shockless movement of the mould, this itself being a good feature. It is of cast iron, and is made in the firm's jobbing shop. It has numerous and different shaped holes in it for two main purposes: first, to allow easy exit of gases from mould; and secondly, to be light and easy to handle.

To get this shockless movement, two strips of wood 4 in. x 1 in. are fitted on the underside, the distance between being such as to give a firm seating of the board on to the track. The fixing of the strips of wood needs careful attention, for there must be no slack movement. First of all ordinary wood screws were tried, but it was soon found that something better was required to withstand the wear and tear to which they are subjected. Eventually one was designed with four arms cast on the underside with an inside taper, thus enabling the strips of wood to be driven through and so holding it securely. A further stage now uses four smaller strips from which the same results are obtained, and moreover, wood is saved.

FIG. 4.—CASTING OPERATION AT THE END OF THE CONVEYOR.

Pattern Rack

By having the rack shown in Fig. 9 servicing this unit, patterns ready for use are always available, and patterns are only returned to the stores when an order is completed. Then another one is put on the rack so that jobs for the unit can be planned ahead. Patterns are kept quite systematically, cope, drag and squeezer board for each set being together. The rack is of very simple construction, but it is adequate for the purpose.

Close to the pattern rack there is a small cupboard. This answers several purposes, chiefly, housing operators' clothes or teacans, and thereby always ensuring a clean and tidy unit.

Flasks and Storage

On each unit three different types or sizes of flasks are used, there being 40 sets of each allotted. This is the number the track will hold when full. The two sets not being in use, are stacked carefully in what is termed the flask storage, and thus are easily accessible when needed. They are periodically checked for wear in the pin holes or distortion on the joint face, and any found defective are immediately taken out of use and repaired.

FIG. 6.—THE KNOCK-OUT "HORSE."

A Small Moulding Unit

All flasks are being fitted with wedge-shaped strips on the side for clamping purposes, and there is only one standard clamp used for all types of flasks. The management is also fitting all flasks with interlock bushings. This new type of bushing has considerable advantages over the old method of just plain bushing and pinning up.

The cope half of the pattern needs no alteration, but the drag pattern needs one female round and one elongated bushing. The drag flasks are fitted with male bushings, and these engage with the drag pattern bushing. The cope flask bushings are fitted to the cope flasks, there being one round and one elongated. The closing of mould is a simple operation, one pair of pins being made with a pilot to enter the inside of the male bush in the drag flask.

The cope then slides down pins and locates over the bushings protruding above sand joint of drag mould. This eliminates the operation of putting in pins after the closing, as no movement or disturbance of the mould can take place. The cost of closing or pouring pins is entirely cut out, and therefore large savings in big foundry plants is assured. The life of the male and female bushings in flasks vary according to the rate of production, but the inspection of female bushings in drag pattern is most important.

FIG. 5.—KNOCK-OUT STATION SHOWING AT EXTREME RIGHT THE RETURN CONVEYOR FOR THE BOXES.

"Sharman 'A' Cover"

The "Sharman 'A' cover" shown in Fig. 10 is a typical casting made on this unit. The risers and runner bush both being on the squeezer board, showing what a saving can be made from the old method of putting running and riser bushes on.

It will be seen that a whole foundry can be planned out on this method, the casting monorail running parallel with casting stations on the units so that the metal can be delivered to any unit in the shortest time.

Constitution of Green Sand Used

The base sand consists of

FIG. 7.—SAND CONTROL BOARD.

FIG. 8.—THE SPECIAL BOTTOM BOARD USED.

Somerford (Congleton) silica sand which has a base permeability of about 130 (A.F.A. No.). This bonded with 5 per cent. Colbond and 3 per cent. Fulbond No. 1A. The coal dust content is about 9.5 to 10.5 per cent. The backing sand contains about 7 per cent. of coal dust, and is sent for remilling into facing and has sufficient coal dust added to maintain a content of about 10 per cent. One part of Fulbond 1A is added to 2 parts of Colbond per mix. This represents about 1.5 per cent. new clay addition.

The sand has the following characteristics:—

Facing.—Moisture, 3.5 to 4.5 per cent.; permeability, 45 to 50 (A.F.A.); green strength, 8.5 to 10 lbs. per sq. in.; shatter 70 to 80 per cent.; and dry strength, 100 to 120 lbs. per sq. in.

Backing.—Moisture, 4.0 to 5.0 per cent.; permeability, 45 to 50 (A.F.A.); green strength, 4.5 to 6.0 lbs. per sq. in.; shatter, 50 to 60 per cent.; and dry strength, 60 to 70 lbs. per sq. in.

FIG. 9.—A SERVICE PATTERN RACK IS USED.

FIG. 10.—EQUIPMENT FOR A TYPICAL CASTING MADE IN THIS UNIT.

CUTTING MAGNESIUM: WET *v.* DRY

Contrary to American practice, the English users of magnesium recommend dry cutting, even at high speeds, claiming that cutting fluids reduce chip recovery, and that in present times this cannot be allowed.

Plants machining magnesium at high speeds and using cutting fluids in the recommended manner have practically no trouble with fires, while those machining at comparable speeds and machining dry do have fires.

While these fires are usually small and easily controlled, their presence is a hazard that can and should be removed. Experimental tests on chip recovery have shown that reclamation of clean oily magnesium chips is practically as efficient as that for dry chips.

Thus, from the standpoint of recovering metal, the use of cutting fluids is no real objection. While the English practice may have merit, observations in many large machine shops in this country indicate that the best machining practice for magnesium encourages the widespread use of cutting fluids.

In the interest of safety and maximum production, mineral oil-base cutting fluids conforming to the recommended specifications should be used in the machining of magnesium alloys if high cutting speeds are used or if the work must be cooled.—Mr. A. E. Carpenter, in "Metals and Alloys."

RIGHT OF COMMON USAGE

Because it was agreed internationally that niobium and not columbium should be the name of that twice christened metallic element, THE FOUNDRY TRADE JOURNAL has consistently supported the arrangement made. In this policy it has been ploughing a lone furrow and from now onwards the name columbium will be used. The reason for this change is right of "common usage," coupled with a respect for priority, as instanced by this extract from an American article:

Tantalum is an element—officially No. 73. It was so named by Ekeberg, the Swedish physicist, in 1803, because, though it seemed always to be within his grasp, he never succeeded in separating it from the other elements in the ore. Thus it derives its name from Tantalus, the mythological Greek character, sentenced by the gods to stand up to his neck in a lake whose waters always receded when he tried to drink them and above whom hung laden branches which ascended whenever he sought to pluck the fruit.

Two years before Hatchett, an Englishman, working with a strange new black mineral found in Connecticut, noted a new element which he called columbium, because of its origin. Ekeberg found two metals to be invariably closely associated in the ore, and he renamed tantalum's sister metal niobium, after Niobe, sister of Tantalus.

RESEARCH AND DEVELOPMENT*

By G. W. NICHOLLS

The advancements made in recent years in the foundry industry should be exceptionally gratifying to all who have laboured diligently in the common cause. These advancements have resulted in the production of cast irons and non-ferrous alloys possessing such a variety of properties, including increased tensile, transverse and compression strength, wear, corrosion, heat and abrasion resistance, far in excess of even the most visionary of 20 years ago.

Not only have these advancements been made in the birth of new irons and alloys, but also in methods of production—so much so, in fact, that it can be truly said that founding is no longer an art but a science, and this must be universally recognised.

These have only been possible by careful research and study of the numerous problems involved in meeting the stringent requirements of modern engineering specifications. This has resulted in the necessity for improvements in practices, use of improved raw materials, development of heat treatment, and fuller application of metallurgical knowledge. Great benefits have been attained by the increased co-operation between the designer, patternmaker, moulder and metallurgist, each one in turn now realising more fully some of the difficulties of the other's problems.

Wartime Research

Whilst great progress was being made just prior to the war in research and development, it by no means ended at its outbreak. Perhaps in certain branches it may have appeared to have been abandoned, yet when the time arrives for reviewing the achievements and advances made during the present conflict, everybody will be amazed at the great amount of research and development actually carried out in order to increase production. This same spirit and progressive policy must be kept alive in peacetime if industry is to maintain the same rate of progress.

The time is not far distant when every foundry, or group of foundries, must be controlled by a metallurgical section if they wish to manufacture to modern specification limits. A point that has invariably been encountered by the writer is the large number of the younger personnel who apparently are lacking in a general knowledge of the properties of foundry materials and the laws of elementary science. The moulder has so many problems that it is essential that something be done, not only by the technical institutions, but also by the employers, to rectify this failing, thereby giving to the industry craftsmen with an adequate knowledge of science, and thus keeping pace with progress made in methods and materials. Also, if the cast-iron industry is to continue this recent progress, some study must be directed to the question of the possible shortage of skilled labour in the future. Schemes will have to be put in hand at once to encourage youths to enter industry, and then to train them. Whatever scheme be adopted, the subject of practical metallurgy must be stressed, inasmuch as this has played an important part in the recent developments and is, therefore, a subject of which every newcomer to the industry will have to attain a workable knowledge if he is to advance. Since this Paper was originally planned 18 months ago a great deal has been published by both the Institute of British Foundrymen and the Government relating to this.

Research and development consists of any work carried out in a scientific and systematic manner, either by force of necessity or design, which results in an advancement of knowledge in workable explanations and theories, or the development or modification of processes, or utilisation of new materials to further the improvement in the final product of manufacture. It may be asked by what methods such work is conducted, but to this the answer must be that the methods must depend upon the problem. The following skeleton description gives a conception of the department and organisation required to conduct such work.

Scheme of Organisation

The Department may be referred to as a "research and development department," or, simply, as a "laboratory." It must be adequately equipped and staffed to carry out efficiently all problems that arise, and should comprise at least the following subsections:—

(1) *Chemical Section.*—In this department all chemical analysis of raw materials, including pig irons, alloys, fuels, sands, slags, refractories, gases and corebinders are conducted.

(2) *Physical and Mechanical Section.*—Here all mechanical tests, such as tensile, transverses, hardness, impact, wear, machinability and heat treatment are made.

(3) *Metallographic Section.*—Here micro-structures are examined and the effects of melting conditions and physical treatment on them; examination of defects and the effects of heat treatment on structures are determined.

(4) *Moulding Materials Section.*—This department controls the physical properties of all moulding materials. It undertakes such tests as moisture, permeability, green and dry strength, grain size, distribution, expansion, conduction, etc.

(5) *Melting Section.*—For the calculation of furnace charges, pyrometric check of melting and casting temperatures, recording blast conditions, special casts, shrinkage and fluidity tests.

(6) *Inspection Department.*—For the recording of defective castings and methods of elimination, inspection of moulds and castings. The personnel in this department will be expected to work in close contact with the melting and moulding material sections.

(7) *Technical Section.*—This comprises the library and office wherein the filing of all correspondence, abstracting of all technical literature, recording of all laboratory data, scientific and technical literature are conducted.

(*Concluded on page* 184.)

* Abridgement of a Paper read before the West Riding Branch of the Institute of British Foundrymen.

THE ENGINEER AND FOUNDRYMAN*

By W. E. MOULDING, M.V.I.E.

Discusses plant maintenance and advises standardisation

Foundry work has been described as that branch of engineering which deals with the melting of metals and the subsequent pouring of them into moulds to form castings. With this in mind, the engineer and the foundryman should feel they are working side by side in order to further each other's interests.

Foundry Equipment

The modern equipment which has been, and is being, produced by the engineer to assist the foundryman to produce a better casting at a lower cost includes moulding and coremaking machines, sand-handling plants (for new and reconditioned sands), drying stoves, melting furnaces, electric cranes, scrap-handling devices, ladles, pneumatic and electric tools for fettling purposes, annealing stoves, and cleaning equipment. Included with these may also be efficient lighting (natural and artificial) and efficient ventilation, including dust-collecting apparatus.

With all this mechanisation of the foundry, the engineer has again to play his part in maintaining it. This is one of his most important duties, and this has been well expressed in the following:—"The purpose of plant maintenance is to anticipate and prevent to the greatest possible extent interruptions in operations and loss of output due to bad order or broken-down machinery and equipment in a manufacturing concern." It is hardly necessary to warn foundry executives about their maintenance organisations being too large or efficient, the tendency is usually towards the other extreme. It is important that due consideration be given to maintenance costs, and that they be kept within reasonable limits.

The production man is constantly urged to keep down his costs, and it is a temptation for him to cut maintenance of plant and equipment. This is rather a short-sighted policy, as deferred maintenance may ultimately become an expensive item in any organisation. The foundryman should, wherever possible, standardise on his machinery and equipment. It is then practicable for the engineer to carry spares for a large part of the plant at a comparatively small cost.

Foundry equipment should be selected or designed with two thoughts uppermost in one's mind; first, its application to the job, *e.g.*, whether it will do its work properly, and, secondly, low maintenance costs over long periods of service. Due to the very nature of the materials handled in the foundry, it is imperative that maintenance on all plant and equipment should start immediately after its installation. If this is not carried out systematically, high maintenance costs will have to be met to keep the plant operating, and the expense necessary to restore it to anything like its original efficiency would, in many instances, be very great.

* A Paper read before the Institute of Australian Foundrymen.

Compressed Air

The single-stage, single-acting air compressor, when compressing to 80 lbs. per sq. in., has a normal overall efficiency of approximately 66 per cent. (the outlet temperature from the compressor is about 485 deg. F.), but if the machine which is using the compressed air is some distance away, thus allowing the air to cool down to approximately atmospheric temperature, the efficiency may drop as low as 50 per cent. The two-stage compressor is the more economical unit, particularly when intercoolers and aftercoolers are used.

The air-cooled two-stage unit compressing to 80 lbs. per sq. in. has an efficiency approximating 78 per cent., with an outlet temperature of 243 deg. F., while the water-cooled two-stage has an efficiency of approximately 82 per cent., with an outlet temperature only 15 to 20 deg. above atmospheric temperature, in both cases intercoolers and aftercoolers were used. Air leaks may become very costly. Take, for instance, an air line with a pressure of 80 lbs. per sq. in., a $\frac{1}{4}$-in. dia. hole drilled in this line will require approximately 4 h.p. to maintain the pressure, and if a $\frac{1}{4}$-in. hole was drilled, approximately 16 h.p. would be required. It is obvious that careful maintenance of air lines and discriminate use of air will, over periods, save much expense.

Casting Design

The following deals largely with steel casting design, but the same may be said to a certain extent for other types of castings. In the production of steel castings success depends to a large extent on the close co-operation between the engineer or designer and the foundryman. It should be the duty of the engineer to consider the viewpoint of the foundryman, and to study some of the problems which he encounters during manufacture.

There is generally a tendency among the foundrymen to accept the design of the casting submitted by the engineer without drawing his attention to any part or parts which may cause difficulty in producing a sound job, or will tend to increase production costs. If the particular portions that may cause trouble are not brought under the notice of the engineer, he will not be aware of any trouble or increased cost which may result therefrom. While it must be admitted that losses occur in the foundry because of unsound practice, it must be pointed out that the lack of understanding by the engineer of the design problems is very often responsible for many difficulties in the production of satisfactory castings.

The initiative definitely belongs to the engineer where co-operation with the foundryman is concerned. The design originates in the mind of the engineer and is then developed; and this would be greatly facilitated if the broad fundamentals of steel founding

The Engineer and Foundryman

were understood by the engineer, and also if he would avail himself of the valuable information which the foundryman can give when the design is in its development stages. When developing a design, it is as essential to understand the characteristics and behaviour of the metal in the mould as to know its characteristics and behaviour under working conditions. The stresses set up in cooling, the influence of one section on another, and the numerous factors which enter into the production of castings have a large bearing upon the cost and ability of the casting to meet the conditions of service to which they are allocated.

It will, no doubt, be generally recognised that the steel casting is influenced by design, more so than many other types of castings, steel having a higher melting point and pouring temperature, greater eroding influence on mould material, and greater shrinkage and contraction. This greater shrinkage and contraction through the cooling range from pouring to room temperature presents one of the most difficult problems. Shrinkage may be defined as the contraction or difference in volume occupied by the molten metal which fills out the impression left by the pattern in the mould, and the volume occupied by the metal after it has cooled to room temperature.

Freezing Conditions

When the molten metal is poured into the mould, the surface in contact with the sand is almost immediately frozen. The metal inside this frozen shell can now only give up its heat by conduction and convection through the solid casting, which in turn must pass the heat through the mould walls or cores which are momentarily becoming hotter. The shell, which has now assumed the size and shape of the sand mould, becomes thicker as more metal is added; consequently sections of a large mass require a relatively long period to freeze. Remembering that at the pouring temperature the metal just filled the mould, by the time the centre freezes it has become more dense and materially smaller, although the initially frozen shell still remains approximately the size of the mould, unless this metal is feeding continually a cavity will be formed in the centre of the section. It is necessary that the riser be of sufficient size so that the metal will remain fluid until the casting it feeds has frozen and taken the necessary metal from the riser to make it solid. Not only must the riser remain fluid, but the junction of the head and casting as well. This is usually accomplished by making the junction or neck as short and thick as possible. After the casting has solidified, it continues to shrink until it reaches room temperature. This is called solid shrinkage, and it continues except for a slight reheating or microscopic expansion at the recalescent point. This is the shrinkage which causes cracked and distorted castings, and is one of the difficulties with which the foundryman has to contend.

Volume Contraction

Ordinary steel which is used for the majority of steel castings has a volume contraction from normal pouring temperature to the room temperature of approximately 9 per cent. A part of this contraction, approximately 3 per cent., takes place while the metal is liquid. The remainder of this contraction occurs after solidification; hence the need for shrinkage allowance when making patterns. The material result of this shrinkage peculiarity in the finished product is influenced tremendously by casting, size, shape, and mass. All new designs are new problems, some being quite simple, others extremely complex, and the steel-founder must anticipate the behaviour of the metal through the solidifying and cooling stages in all parts of the casting.

It is essential to prevent hot spots in a casting, and if it is possible, it should be so designed that all the members should increase in thickness to a position where a riser could be placed. The ingot is a typical example. It is often impracticable to allow for this gradual tapering to a centre. It is then necessary for the foundryman to provide extra risers. While this is a way out for solidification shrinkage, it very often causes strains which may lead to cracks, due to restricting the full contraction of the casting after solidification.

Use of Oil Sand for Strain Relief

To try and relieve these strains the foundryman may remove the sand around the riser as quickly as possible after casting, or place an oil-sand cake on the side of the riser in the direction that contraction will take place. This is by far the better arrangement. Where there are a large number of risers required, considerable resistance to contraction would be encountered if some effective method was not resorted to. The amount of metal that is used for risers on a casting depends entirely on the design of that casting. It cannot be assumed that all castings of the same weight will have the same amount of risers. This varies considerably. Take, for instance, a cast steel shoe as used in a battery. This particular shoe weighs 1¼ cwts., and the amount of riser required to feed the shoe, and make sure that the body of the casting is solid, would be approximately 1¼ cwts., so that the amount of riser in this case to the finished casting is about 85 per cent.

Now take the case of a frame casting, the weight of which is 1¼ cwts., and the amount of metal required for feeding in this particular instance is ¼ cwt. This percentage decrease in feeding metal required is due, of course, to the more even thin sections of the frame casting, which cools very rapidly. The only portions which need feeding are the bosses.

Gear Blanks

Now let us consider the ordinary gear blank, which in the case of the steel casting has been a bugbear to engineers and gear cutters. The amount of head metal required to produce a sound casting represents a fair percentage of the weight of the finished gear. If

there is a cavity in the rim, it occurs usually at the root of the teeth, and is very often exposed only when the teeth are being cut. This very often leads to the rejection of the casting, which has usually had a considerable amount of machining done on it prior to gear cutting. The practice usually adopted for gear blanks of the H-section arm type is to fit a ring of metal, which is called the dirt ring, on the upper edge of the rim. On top of this is then fitted a number of risers equal to half the circumference of the rim around, equally spaced, *e.g.*, if the riser be 15 in. long, a space of approximately 15 in. would be left before meeting the other riser. The height of the risers depends, of course, on the width of face of the gear. For a 6-in. face gear the thickness of the dirt ring would be about 1 in. and the riser about 6 in. high, and for a 12-in. face gear the thickness of the dirt ring would be about 1½ in., and the riser about 10 in. high. The thickness of these risers varies naturally with the thickness of the rim, but is usually equal to the thickness of the rim plus ¾-in. overhang on each side of the rim on small gears, about 1-in. overhang on medium-size gears, and about 1¼-in. overhang on large gears. It will therefore be seen that the cost of removing the dirt ring and risers will be considerable, and also the cost of the removed metal must be taken into consideration, but this will be a small item when the wheel is solid, compared with the cost of repairing, or in a good many cases the cost of remaking the gear.

Holes in Heavy Sections

When relatively small holes are required in thick sections of heavy castings, it is preferable to avoid using cores, and to drill the holes required. The objection to coring in such cases is as follows:—The core may interfere with the placing of a sufficiently large riser to feed this thick section. The core may "burn in" due to the heavy section of metal surrounding it. This will subject the sand to great heat, and will cause the fusing of the sand and metal. This, in turn, will play havoc with the boring bar or drill, and the time required for machining is usually much in excess of the time taken when drilling from the solid.

When the casting design includes fairly heavy sections in parts where the risers cannot function, the foundryman must resort to other methods to obtain a solid casting. This may be accomplished by the use of internal or external chills. The internal chill is fitted in the mould in a position where the heavy section is located, so that it will be completely surrounded by fluid metal. This cools the section more quickly, and allows it to cool at approximately the same rate as the remainder of the casting. The material the internal chill is made from is usually of the same composition as the metal with which the casting has to be cast. The chill must be clean. and must not be left in the mould too long before it is cast. If this is not taken care of, the metal is likely to blow off the chill, thus leaving a cavity around it. If the chill is too small, it does not cool the section sufficiently; thus there is still a possibility of contraction cavities existing at these points.

External chills are also located where heavy sections exist, but in this instance the chilling material forms a portion of the face of the mould or core. If the external chill is too small, it has a tendency to burn on the casting, and does not have the desired cooling effect. If the chill is too large, small surface cracks are likely to appear. It is therefore evident that very careful thought and consideration must be given to chilling whether internal or external.

Use of Fillets and Brackets

The use of fillets at all inter-sections is most desirable, not only from the strength standpoint, but it eliminates the possibility of the metal washing away the thin body of sand formed by sharp corners. It is necessary that the size of the fillets should be in keeping with the rest of the casting. If the fillet be too small, cracks or tears are likely to occur at such points. While if the fillets are too large, a thick localised section may be produced which may cause a weakness due to a shrinkage cavity.

Angle brackets are often used by the foundryman to support sections that are subject to contraction stresses when the casting is passing through its critical period. The brackets are made of a relatively thin section, which will solidify much sooner, thus supporting the sections concerned. These brackets are removed in the fettling shop prior to the delivery of the casting. There are many cases where castings do not shrink normally, and it is these cases that make the subject more difficult to handle.

Steel castings with projections, such as pipes or pipe fittings with flanges, are subject to this trouble; a safe precaution is to allow for more metal to be added to the back of these flanges, so that, should the casting not contract to its full amount, there will be sufficient metal on the flanges to maintain its thickness after machining. The same may be said for gear wheel blanks, particularly those of a fairly large diameter, when extra metal is allowed for on the underside of the rim; the amount of this extra metal is usually arrived at by making the inside diameter of the rim, when making the pattern, to between iron and steel contraction, and the outside diameter to full steel contraction, so that, should the casting not contract to its full extent, the extra allowed on the inside will permit the rim to be machined to the correct thickness. On the other hand, if full steel contraction be obtained, the gear will still have sufficient metal to clean up the outside diameter.

Gear Wheels and Pulleys

In large cast steel gear wheels or pulleys where the amount of contraction would be considerable, it is desirable to split the boss by the use of splitting cores. In the case of, say, a six-arm wheel, three such cores may be used. These cores are usually about 1 in. in thickness, and cut the boss into three equal parts. This allows the arms to contract more fully, thus tending to eliminate the possibility of tears at the junction of the arms and rim and the arms and boss. The slots through the boss formed by the cutter or splitting cores are machined or chipped clean, and mild-steel plates are then fitted in and welded. During

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the machining of the wheels, landings are turned on each side of the boss, and on each of these is shrunk a ring. These, along with the welded plates, locate the boss in a fixed position.

Pattern equipment as well as design has a considerable effect on the cost of the casting. This should be in keeping with the type of the job on hand. If there is only one casting required off a pattern, it would be too costly to produce elaborate pattern equipment, so that a pattern manufactured as cheaply as possible would be used, provided it is so constructed that it does not cause excessive moulding costs. In a good many cases an extra hour spent in the patternshop may often save two or more hours in the foundry. The design of the casting affects considerably the cost of the pattern. The more simple the design, the less the pattern cost usually, particularly if hand work on the pattern could be reduced to a minimum. It is in the interest of the engineer to consult the foundryman regarding the pattern equipment on any job. It will, in a good many instances, save him much time and expense. Faulty design very often delays production, and complaints are frequently made that castings take much too long a period to pass through the foundry. When this has been inquired into, it is usually found that the design has been a faulty one, and several trials have had to be made to arrive at the best method of eliminating tears or contraction cavities, or other faults which may eventuate. In some instances where, through the design, it is impossible to produce a casting which will not persist in distorting, it becomes necessary to distort the pattern in the opposite direction, to enable the foundryman to produce a straight casting.

Where large quantities of castings are required, plate moulding should be resorted to. This usually necessitates costly pattern equipment, but it will reduce foundry costs considerably, particularly when a number of patterns can be fitted on a plate. Up to a few years ago the foundryman eliminated cores wherever possible, but to-day, thanks to oil-sand cores, he has made much greater use of them, even to the extent of manufacturing complete moulds from cores, eliminating moulding boxes altogether.

Wherever internal cores are situated, the design should provide sufficient openings through the casting for the necessary support of the core, and also to allow for the free escape of the gases generated in the core when the molten metal comes in contact with it. Take, for example, a hydraulic cylinder. If it is possible the design should be such that the core is able to be supported at each end; that is, the core to pass through the bottom, and the hole formed by so doing may be plugged by shrinking in a plug which may then be welded on the underside.

In conclusion, there are many instances when a preliminary discussion between the engineer and the foundryman would result in saving both time and money, and also, which is perhaps just as important, in the obtaining of a sounder casting.

RESEARCH AND DEVELOPMENT

(*Concluded from page* 180.)

This department will be expected to operate under one head capable of carrying out the necessary control and giving technical advice when necessary. The above does not imply that the only persons capable of carrying out the research and development are those persons employed in such a department, but simply that this department should be the centre in which the scientific work is conducted, all of which must be correlated and used in collaboration with the designer, pattern-maker, moulder and customer.

Finally, a survey is given of some of the advancements that have been made in metals, materials, methods and plant.

(1) Cast iron has gradually been improved until strengths 2 to 3 times those obtained 25 years ago are now attainable; light alloys and copper of remarkable properties have appeared. Amongst these are the cast irons, Meehanite, Perlite, Ni-tensile Ni-hard, Nomag and acicular, and in the non-ferrous group Alpax, heat-treatable Duralumin and Electron, beryllium copper, P.M.G. and Everdur. These have only been possible by a careful study of structures and their correlation with composition, melting procedure and subsequent treatment and moulding methods.

(2) Moulding sands have received a great deal of attention, and are now, in most foundries, subjected to greater scientific control than ever before, although there are still some who fail to realise its importance. Investigations dealing with ideal grain size, thermal conductivity, refractoriness, permeability and strength of natural bonded and synthetic sand mixtures, have all been necessary to indicate the reasons for defective castings and the attainment in improvements which are being produced in the quality of castings.

(3) New technique in moulding methods, such as the use of various types of runners and risers have been evolved to ensure sound and dense castings, and also to cope with the poor fluidity with some of the newer alloys. The use of mechanisation to speed up production and to eliminate some of the heavier work involved in certain types of moulding is outstanding.

(4) Cupola control is now greatly improved, so much so that very close control over that variable element, carbon, is now possible, coupled with higher tapping temperatures, and these are two of the essentials in the production of high-duty cast iron.

From these remarks it will be realised how much valuable work must have been carried out to further the science of casting, but there is as yet still a great deal to be learnt, particularly as far as the actual nature of the reactions in molten cast iron and the effects of these on life, and the quality of the final product. As one author recently said: "More has been added to the subject of cast iron in the past 15 years than in all the years of the history of the industry." Therefore, with encouragement in the field of research and development, there will, no doubt, be produced from the hat during the next few years further discoveries from which the foundries will derive considerable benefits, provided they are organised and controlled.

PRODUCTION RESULTS WITH A BASIC LINED CUPOLA*

By C. HEIKEN

Because of the interest aroused by Mr. Renshaw's Researches on the Basic Lined Cupola this B.C.I.R.A. Translation is reproduced

The interest displayed by the experts during the last twenty years in the previously neglected cupola process has found expression in a series of articles showing the beneficial influence which a suitable selection of the charge constituents and appropriate management of the melting process, etc., can have on the composition and quality of the metal produced. In all cases where ordinary cupola practice was used for the determination of results, cupolas lined with the usual materials were used. The following account of results obtained with a basic lined cupola should therefore be of interest.

The converter process, used increasingly in the foundry for the manufacture of steel castings towards the end of last century, was at first considered unsuitable for the production of high grade castings, as the quality of the product was considered inferior by the consumer because of its relatively high sulphur content. The acceptance of converter produced castings was subject to stringent specifications. In order to make the converter process an economic proposition it was necessary to use up completely the steel scrap runners and risers, etc., with their relatively high sulphur content, and in addition to include bought scrap. The sulphur content of the charge, which consisted of 40 to 60 per cent. hematite pig-iron and 60 to 40 per cent. steel scrap, increased during the melting process due to sulphur pick-up from the coke, so that as a rule the sulphur content of the product was expected to be between 0.07 to 0.08 per cent. This high sulphur content favoured the appearance of hot tears in the steel castings.

A steel foundry attempted, therefore, in 1905, to melt iron for the converter in a basic lined cupola, using a highly basic slag, with the object of preventing sulphur pick-up from the coke, and at the same time desulphurising the metal.

A 20 in. diameter cupola at the disposal of the company was lined with magnesite bricks, and the usual charge was melted down with the addition of dolomite and fluorspar. The analyses of eight 2,200 lb. charges from three melts are shown on the upper portion of Table 1. To enable a comparison to be drawn the results obtained from eight charges with the usual lining are shown on the lower section of the table. The same charge, containing 50 per cent. steel scrap, was used in each case. The analyses obtained with the basic process show slight variations, but considering the fact that these melts were only experimental, it is probable that these fluctuations are due to special circumstances. The fact that the sulphur in the other charges has been largely removed shows that the experiments were in the right direction.

A comparison of the results shown in Table 1 is interesting. Particularly noticeable are the high carbon contents obtained with the basic process, an average of 3.686 per cent. C., whereas the average with the normal process is only 2.846 per cent. C. The silicon content from the basic lining is low, and was brought to the level required in the converter process by the addition of high silicon ferro-silicon. In the usual process the silicon content obtained is normal. The melting losses of manganese are considerably lower in the basic process, and the phosphorus content is reduced despite the high carbon content. The most favourable influence of the basic over the normal process is shown

TABLE I.—*Experimental and Comparative Melts* 1905/1906, *each of* 2–3 *Charges of* 2 200 *lb. each.*

Charge No.	Cupola with basic lining.				
	C Per cent.	Si Per cent.	Mn Per cent.	P Per cent.	S Per cent.
1556	3.52	0.865	1.396	0.065	0.019
1557	3.48	0.865	1.465	0.069	0.018
1558	3.63	0.813	1.306	0.075	0.018
2172	3.51	0.235	0.939	0.040	0.025
2173	3.57	0.395	1.025	0.048	0.038
2223	3.84	0.395	1.521	0.060	0.010
2224	4.036	0.301	1.419	0.055	0.0073
2225	3.888	0.687	1.401	0.062	0.0049
Average ..	3.686	0.563	1.429	0.059	0.0175

Charge No.	Cupola with ordinary lining.				
	C Per cent.	Si Per cent.	Mn Per cent.	P Per cent.	S Per cent.
1327	2.653	1.312	0.920	0.093	0.068
1359	2.773	1.608	0.503	0.094	0.057
1372	2.978	1.232	0.742	0.097	0.087
1492	2.898	2.068	0.999	0.097	0.080
1495	2.775	1.927	0.920	0.095	0.075
1501	2.910	1.578	0.908	0.085	0.036
1503	2.820	1.462	1.039	0.086	0.092
1512	2.962	2.003	0.918	0.079	0.084
Average ..	2.846	1.655	0.869	0.091	0.077

* Translated from "Die Giesserl," October 26, 1934.

Basic Lined Cupolas

in the sulphur contents, which give an average of 0.0175 per cent. as opposed to 0.077 per cent.

High Silicon Losses

The composition of the slag formed in the basic lined cupola using basic fluxes is similar to that of the deoxidation slag in the electric furnace. The calcium content of slag and lining forms calcium carbide with some of the carbon of the coke, and carbon from the coke, together with silicon from the pig-iron, forms silicon carbide. The desulphurising process is therefore the same as that used in the basic electric furnace. This also explains the high silicon loss which is a necessary prerequisite for a good desulphurisation, and must be accepted as such. The steel blown from the basic melted iron had good properties, and a little attention from the moulders almost completely eliminated hot tears. The castings were accepted without objections being raised on the part of the inspecting authorities.

As the results obtained continued to remain favourable after a longer experimental period, it was decided to reline a somewhat larger cupola with an internal diameter of 27 in., but this time a rammed lining of sintered dolomite and anhydrous tar was substituted for the magnesite bricks. The results obtained with this furnace completely confirm the observations made with the experimental cupola, and are shown in Table II.

When, after a longer period of operation, the usefulness of the process was also established with this furnace, it was decided to change over the whole plant to the basic process. Two further cupolas of from 30 to 36 in. internal diameter were accordingly relined and worked on the basic process. Further control of the process was carried out with samples taken at random, usually from the second, fifth and last charges each day. Ever higher demands on the melting capacity of the furnaces were made with progressive developments in the steel foundry, the weight of the converter charges were increased from time to time to 3,300, 4,400, 5,500 and 6,600 lbs. It was found that with increased furnace output the sulphur content increased with an increase in scrap in the charge during the day, although it still remained in permissible bounds. The existing records about the run of previous melts showed that with decreasing pig-iron and increasing scrap content in the charge, that is with decreasing silicon content, the sulphur content of the molten metal shows an increase.

The possibility of increasing the silicon content of the charge by using 12 per cent. silicon ferro-silicon instead of pig-iron in the charge was examined. In order to investigate the effect of this, it was decided to alter the composition of the 7th, 8th and 9th charges to 88 per cent. steel scrap and 12 to 13 per cent. of 12 per cent. ferro-silicon. The following two charges consisted of 40 per cent. hematite and 60 per cent. scrap. Fig. 1 shows that a high increase in sulphur took place with these charges, which decreases again only with the use of hematite in the following charges. The calculated silicon contents of the sixth to eleventh charges were the same in each case. When ferro-silicon was not used, other melts of similar charged silicon content did not show a similar increase in the sulphur content. It is obvious, therefore, that the cause of the sulphur increase is the addition of silicon in the form of ferro-silicon.

This phenomenon can be explained in the following way. When hematite pig-iron is used in the charge the silicon, being a comparatively small part of the total percentage, is in comparatively small danger from oxidation in the melting zone. The amount of oxide produced, *i.e.*, silicon, is limited, and the silicon in the molten bath of metal is able to act as previously described. When 12 per cent. ferro-silicon is substituted for hematite in the charge, the silicon is less protected in the melting zone and is highly oxidised. The high silicon slag formed intermixes with the strongly basic slag from the molten fluxes, and decreases its basicity. The reducing properties of the slag are thus diminished and the desulphurising action is decreased.

Having arrived at this conclusion, it was decided to discontinue the use of a high percentage of scrap together with ferro-silicon. The proportion of

TABLE II.—*Ten Charges of* 3,300 *lb. each* (*January* 18, 1907).

Charge No.	Charge.		Calculated content of charge.			Analysis of the molten iron.		
	Hematite. Per cent.	Steel-scrap. Per cent.	Si Per cent.	Mn Per cent.	S Per cent.	Mn Per cent.	P Per cent.	S Per cent.
2873	60	40	2.447	2.820	0.075	1.43	0.046	0.012
2874	60	40	2.447	2.820	0.075	—	—	0.012
2875	60	40	2.447	2.820	0.075	—	—	0.013
2876	50	50	2.050	1.874	0.045	1.242	0.052	0.020
2877	50	50	2.050	1.874	0.045	—	—	0.022
2878	50	50	2.050	1.874	0.045	1.430	0.053	0.021
2879	50	50	2.050	1.874	0.045	—	—	0.022
2880	50	50	2.090	1.970	0.058	—	—	0.016
2881	50	50	2.090	1.970	0.058	2.16	0.065	0.017

hematite scrap used was 60-40 per cent. for the first five charges and 50-50 per cent. for the remainder. Fig. 2 is representative of charges used until the closing down of the works in 1928. The fact that the sulphur content was uniformly kept below 0.02 per cent. is clearly shown, with the exception of the last two charges, where the sulphur content rises to 0.032 and 0.033 per cent., due to the fact that the lining had worn and the rate of silicon and manganese oxidation was increased during the blowing down of the cupola. Even these latter values are still relatively low, and there is no doubt that the quality of castings obtained with the process described was consistently high.

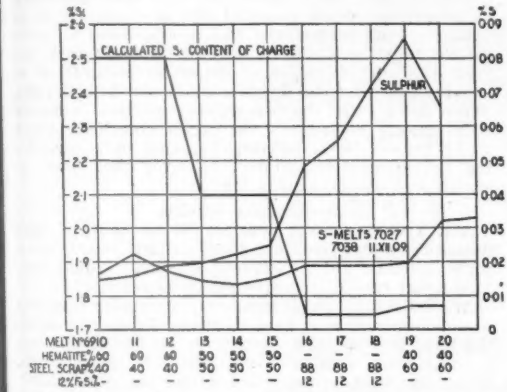

FIG. 1.—SHOWING INFLUENCE OF SCRAP ON SULPHUR CONTENT.

Heavy Lining Deterioration

It is necessary to point out in this connection that the basic lining in the cupola is continually subject to heavy wear. The lining, in eroding away, helps in the formation of a strongly basic slag. It was, however, possible by taking suitable measures to prolong the lining life of the larger furnaces to 12/14 converter charges of 6,600-7,700 lbs. each. For each day's melt the lining had to be repaired by ramming to its original size. The lining in the smaller cupolas withstood only 3/7 charges to 3,300 to 4,400 lbs.

The existing cupola layout did not permit the installation of a fore-hearth, which would have been beneficial, particularly for the larger charges. The iron of these had to be tapped and collected in portions, and the period it was able to be in contact with the desulphurising basic slag was insufficient. With suitable layout and large fore-hearth a more uniform and complete desulphurisation with a longer lining life could have been obtained. It must be stressed here that all samples were taken during the production periods, without previous precautions or measures.

High Carbon Content

The high carbon content of the basic cupola melted iron was previously pointed out when amplifying Table I. This phenomenon was confirmed by the carbon contents obtained from a number of randomly selected samples, shown in Table III. The carbon contents of the molten metal are in the region of 3.85 to 4.37 per cent. in spite of the high percentage of scrap in the charge.

This high carbon content was even more noticeable when an attempt was made to desulphurise charges containing no steel scrap in the basic cupola. The metal was melted hot, and when tapped was found to be highly supersaturated with graphite, some of which

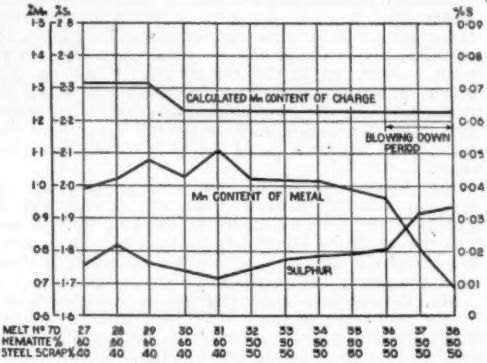
CALCULATED Mn CONTENT OF CHARGE
BLOWING DOWN PERIOD
Mn CONTENT OF METAL
SULPHUR
MELT N° 70 27 28 29 30 31 32 33 34 35 36 37 38
HEMATITE % 60 60 60 60 60 50 50 50 50 50 50 50 50
STEEL SCRAP% 40 40 40 40 40 50 50 50 50 50 50 50 50

FIG. 2.—SHOWING UNIFORMLY LOW S CONTENT WITH BASIC LINED CUPOLA.

TABLE III.—*Showing High Carbon Content in Basic Material.*

Charge No.	Date of melt.	No. of charge for each date of melt.	Charge. Hematite. Per cent.	Charge. Steel scrap. Per cent.	C Per cent.
2809	20.12.06	I.	60	40	3.97
2812	20.12.06	IV.	50	50	3.87
2815	20.12.06	VII.	50	50	4.37
2950	8.2.07	II.	60	40	3.85
2952	8.2.07	IV.	50	50	4.10
2955	8.2.07	VII.	50	50	4.20
2958	8.2.07	X.	50	50	4.20
3000	22.2.07	I.	60	40	3.90
3004	22.2.07	V.	50	50	4.15
3007	22.2.07	VIII.	50	50	4.29
3550	11.7.07	IV.	60	40	4.26
3552	11.7.07	VI.	60	40	4.24

was precipitated in the form of graphite flakes from the melt while it cooled after tapping and while pouring. The space around the cupola spout was covered with graphite flakes over a wide area. The metal in the

(*Continued on page* 190.)

THE FOUNDRY METALLURGIST

EXTENSION OF SERVICES TO THE SMALLER UNITS

After the presentation of Papers* by Mr. J. Stott and Mr. G. W. Nicholls to the January meeting of the West Riding Branch of the Institute of British Foundrymen, an open discussion was held concerning the position of the foundry metallurgist.

The PRESIDENT (Mr. L. Turner), opening the discussion, said there may still be some who wondered whether the chemist was really necessary in the iron-foundry, but he believed his audience deemed such an appointment essential.

MR. W. PARKER said in some of the large foundries where they enjoyed the advantages of a laboratory there seemed to be a measure of animosity against the metallurgists by the production staff, who had, perhaps, been brought up in the old school. There was still much room for a closer co-operation between the production and the metallurgical sides in daily foundry life. The production staff often felt they were not being kept informed as to the purpose of these new ideas.

MR. STOTT said he did not wish to give the impression that the chemist made the casting, but he had his part in it, especially in checking up. It was true that once the metal was charged into the cupola, the chemist could do little or nothing as to altering its composition. In steel practice the reverse was true.

MR. PARKER said one could check liquid cast iron by the chill test and make ladle additions. It did not follow that one must necessarily discard the metal merely because of faulty composition.

MR. J. TIMBRELL asked how temperature could be restored to dull metal.

MR. PARKER said it was done before the days of chemists.

MR. TIMBRELL, agreeing, said he was appreciative of the value of the laboratory. The chemist's work was recently justified when his firm had trouble with plumbago and blacking. If the smaller foundries could have access to scientific control, they would benefit enormously.

MR. NICHOLLS, replying to Mr. Parker's observations on the need for closer co-operation, said that was the position of affairs ten years ago rather than to-day. The reaction of the production staff to the chemist in those early days was due largely to the attitude assumed by the chemist of that day. As Mr. Stott had indicated, if the metal was too high in silicon or other constituent, there was little that the chemist could do.

Why Chemist?

MR. F. K. NEATH, B.Sc., said perhaps the term "chemist" was not the happiest of names for the man concerned. It made some people think in terms of pills and powders. It might be better if he were described more by some such name as "works investigator." It was admitted in the Institute's own Report that anyone who wished to get on in the foundry industry should endeavour to understand the principles of more sides of the craft than his own particular section. The chemist must be a scientist—chemical analyses and control were only phases of the job and it was important that the production side should have some knowledge of the germane scientific principles. The question of research and development opened up a much wider field. People in the ordinary works were busily engaged on day-to-day production tasks and research needed to be carried out away from the daily worries of ordinary production. Much of the most valuable research work was being carried out in technical colleges and laboratories, often by people who have themselves very little knowledge or experience of the practical side as expressed in the ordinary foundry, and the real problem was to incorporate the scientific efforts into the practical work, and that was one of the most important features of an organisation like the Institute of British Foundrymen, which could bring the two sections together in mutual helpfulness. It was only the bigger companies which could usually have, individually, what may be called the development department to bring their own research and practical sides together.

Co-operative Services

MR. TIMBRELL asked whether 50 per cent. of small foundries to-day making good castings were worth some scientific aid to improve quality. Would their production be able to carry the extra expense?

MR. NICHOLLS said the majority of smaller foundries would sooner or later have to group together to secure the joint services of a chemist or analyst if they are to meet the demands of up-to-date specifications. Many of them to-day were producing good-quality castings in a mechanical sense, but perhaps of second class, chemically.

MR. H. FORREST said that, being by training a chemist, though in latter years he had come more in charge of production, he felt he might speak on this subject without undue bias on either side, and he would suggest quite frankly that many of the products of to-day would never have become commercial propositions at all except for the aid of the metallurgical chemist, who had undoubtedly helped to reduce the scrap percentage. It was not essential for every foundry to have a chemist on the premises, but someone on their staff must know something of scientific control to provide a liaison between the scientific and practical. The chemist should be able to guide the production staff. He supported the suggestion of Mr. Neath that the word "chemist" was perhaps not the happiest of names and might be misconstrued. He thought he might more fittingly be called the "metallurgist."

MR. NICHOLLS remarked that, after all, the chemist was a chemist because he studied and worked on chemistry, and he could not, on the whole, see very much wrong with giving him that name.

MR. STOTT quoted the case of a managing director who demanded from the works chemist a precise state-

(*Continued on page* 190.)

* See our issue of February 24 and page 180 of this issue.

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STANTON MACHINE CAST PIG IRON

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Ample supplies direct from stock

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

THE FOUNDRY METALLURGIST

(*Concluded from page* 188.)

ment of the amount of money his work has saved on the balance-sheet to justify his existence. He supported Mr. Nicholls that the title "chemist" was in every way adequate.

MR. S. CARTER pointed out that the question really was, how far and how much further could the chemist be utilised? Many chemists were too timid. The all too familiar problem of shrinkage required more attention from the metallurgist.

MR. NICHOLLS, agreeing, said there were, of course, many things in connection with cast iron which were obscure, but had a direct bearing on the problem of shrinkage. There were in many cases weaknesses in the design of the casting in relation to the job and materials concerned.

Shrinkage

A MEMBER said the question of shrinkage was closely allied with the design of the casting, the gating and feeding. It was true that the high-duty cast irons showed a greater liability to shrinkage. He preferred the title "metallurgist." A trained scientist could contribute substantially to the good of his firm's financial balance-sheet by his investigations, but he must be in a position to correlate his findings with production—in short, as Mr. Forrest had indicated, the chemist must be production-minded.

MR. CARTER said there were problems on shrinkage which were entirely unrelated to gating and risering, and these were matters in which the chemist could render very great service by investigating.

MR. H. BALME agreed that the problem of shrinkage was certainly an immediate case in point for special attention. The chemist, if he was to be worthy of his position, should attempt to produce for us a metal that had a minimum susceptibility to shrinkage.

MR. NICHOLLS said if a foundry or a group of foundries had a properly organised research or scientific department, material control problems could all be worked out. The chemist, after all, could spend his time frequently visiting the foundry if he was to carry out his own work in the laboratory. A separate department was required with some practical men who had had a technical training. If every foreman had a more technical knowledge he would be able to work better with the chemist, and, on the other hand, the chemist himself could well do with some training on the practical side. In the Government's new Education Bill for the post-war years it insisted that whoever enters industry must have a good general education.

A vote of thanks to Mr. Stott and Mr. Nicholls, proposed by Mr. Forrest and Mr. Carter, concluded the evening.

YOUR WASTE PAPER IS STILL NEEDED

INSTITUTE CALENDAR

MEETINGS FOR MARCH 1944

4. *Lancashire Branch.*—Short Paper Competition. At the Engineers' Club, Albert Square, Manchester, on March 4, at 3 p.m.
11. *Scottish Branch.*—Annual Business Meeting and Presentation of John Surtees Prizes. "Some Aspects of the Production of Malleable Iron Castings," by J. Roxburgh. At the Royal Technical College, George Street, Glasgow, on March 11, at 3 p.m.
11. *West Riding of Yorkshire Branch.*—"Moulding Sand and Cases in Relation to Casting Defects," by G. W. Nicholls and R. Oldershaw. At the Technical College, Bradford, on March 11, at 6.30 p.m.
18. *Lincoln Section.*—"Coal Dust—Its Application to Foundry Sand Mixtures," by H. H. Shepherd. At the Technical College, Lincoln, on March 18, at 3 p.m.
18. *London Branch.*—Works visit to Kent Alloys, Limited. "Coreshop Equipment and Control," by F. H. Hoult, on March 18.
25. *Birmingham Branch.*—"Industry and Education," by G. L. Harbach." At the James Watt Institute, Great Charles Street, Birmingham, March 25, at 2.30 p.m.
25. *Bristol Branch.*—"Foundry Technique in General Engineering Casting," by F. Dunleavy; and Annual General Meeting. At the Grand Hotel, Bristol, on March 25, at 3 p.m.
25. *East Midlands Branch.*—Annual Meeting. Short Paper Competition. At the Technical College, Derby, on March 25, at 3 p.m.
25. *Wales and Monmouth Branch.*—"An Atlas of Defects in Non-Ferrous Castings." Non-Ferrous Sub-Committee Report, presented by F. Hudson, on March 25.
31. *Falkirk Section.*—"Swan Song," by J. M. Primrose. Annual Business Meeting. At the Temperance Café, Lint Riggs, Falkirk, on March 31, at 7 p.m.

BASIC LINED CUPOLAS

(*Concluded from page* 188.)

ladle was viscous and covered with a heavy layer of kish, which kept on reforming after skimming. The surface of the castings poured from this iron shows clusters of kish graphite. A chilled sample contained 3.3 per cent. total carbon and 0.011 per cent. sulphur.

These experiments were not continued any further, but indicate the possibility of melting, where large quantities of iron are required, in a basic and ordinary cupola and then mixing the molten metal in different proportions according to the composition desired for the castings. Kish can be avoided when melting in the basic process by including 40 to 60 per cent. of steel scrap in the charge. The return scrap in the foundry is continually desulphurised by this method, and the sulphur content of the castings can be kept to about 0.040 to 0.06 per cent.

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NEWS IN BRIEF

A CANADIAN STEEL FOUNDRY has cut its daily gas consumption used in connection with its mould-drying stoves from 491,000 cub. ft. to 412,000 cub. ft. by means of insulation with vermiculate.

MR. DALTON, president of the Board of Trade, has granted a temporary licence for the manufacture of domestic aluminium articles in Scotland, subject to a suitable factory being found with available immobile labour.

SINCE THE BEGINNING of this year, American iron-founders making less than 100 tons of castings per month have been freed from the obligation to report monthly deliveries, unfulfilled orders, production and capacity.

THE PARTNERSHIP between Walter Leslie Meaking and Walter Meaking, carrying on business as metal merchants at 69-71, Howe Street, Birmingham, under the style of W. Meaking & Company, has been dissolved by mutual consent.

IN THE FIRST NINE MONTHS of 1943, the American foundry industry delivered 148,517 tons of aluminium castings, about two-thirds of which were sand castings. The production of gravity castings leads pressure die castings only by a small margin.

TINPLATE PROCESSES, LIMITED, has been registered with a nominal capital of £50,000 to carry on research in the industry. The subscribers include Richard Thomas & Company, Limited, and other leading West Wales steel and tinplate companies.

THE SCHEME for the reorganisation of the capital of the Newall Engineering Company, Limited, has been approved by the shareholders. It provides for the redemption of the redeemable preference shares and their reissue as preference shares and the sub-division of the existing "A" ordinary shares of 5s. each.

THE ANNUAL REPORT of Samuel Marsden & Son, Limited, bolt and nut manufacturers, states that the decline of £2,943 in trading profit to £13,007 was due to a decreased turnover and continually rising production costs, for which the company receives no recompense. Three special expenditure items—new goods hoists, conversion of forge furnaces to burn creosote-pitch instead of fuel-oil, and new heat treatment plant—cost upwards of £12,000, more than half of which was for conversion to creosote-pitch burning.

THE INTERNATIONAL TRADE POLICY COMMITTEE of the Federation of British Industries has presented a report on post-war international trade policy to the Grand Council, which has adopted its recommendations. The report says that at the end of the war Great Britain will be a debtor and not a creditor nation, with its income from foreign investments and services substantially diminished. To import even on the pre-war scale, this country must increase its visible exports of goods by 40 per cent. or 50 per cent. over the pre-war level. The report is the subject of editorial comment in this issue.

HOLIDAY ADVICE TO INDUSTRY

The Ministry of Labour and National Service, in an announcement giving preliminary guidance to industry in the planning of holidays this year, say that industrial agreements and common practice in relation to the annual holiday should continue in general to be observed. On the occasion of public holidays in England and Wales the following days should in general be approved holidays:—Saturday, April 8, and Easter Monday, April 10; Saturday, May 27, and Whit-Monday, May 29; Monday, August 7; Saturday, December 23, Monday, December 25, and Tuesday, December 26; or, alternatively, Saturday, December 30, and Monday and Tuesday, January 1 and 2. These arrangements provide for one day's holiday in August instead of the two days allowed last year, but for three days at Christmas instead of two.

NEW CALL-UP FROM INDUSTRY

With a view to providing men required for the Forces, the coal-mining industry, and the Merchant Navy, the Government has decided that in future deferment of calling up cannot in ordinary circumstances be allowed for men in certain occupations who were born in or after 1923, 1920, 1915, 1910, or 1905, according to the occupation. Before the men in question are called up their employers will be notified, and will be given an opportunity of making representations to the regional representatives of the Government Department most interested in their work, if they consider it essential that a man should be retained. The employers concerned will be receiving full particulars very shortly.

OBITUARY

MR. GEORGE MURRAY, of Muir, Murray & Company, Limited, furnace builders, Paisley, died recently.

MR. ERNEST G. BYNG, a director of the General Electric Company, Limited, has died at the age of 56.

MR. HERBERT DOUGLAS, manager of the cogging mill at the Rotherham works of Steel, Peech & Tozer, died recently.

MR. JOHN LIVINGSTON, who for many years was one of the principals of John Livingston & Sons, Limited, Zetland Brass Foundry, Middlesbrough, died recently at Saltburn.

MR. GEORGE H. WADSWORTH, founder and president of the Wadsworth Core Machine and Equipment Company, of Akron, Ohio, died recently at the age of 87. He was born in Chester, but went to the United States in 1880. He visited this country to participate in the 1929 international convention.

PERSONAL

MR. P. J. HABERSHON has been elected a director of Arthur Lee & Sons, Limited, steel rollers, of Sheffield, in place of the late Mr. A. R. Habershon.

MR. D. G. BROWN, managing director, has received a presentation on completing 25 years with the Redheugh Iron & Steel Company, Limited, Gateshead.

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for STEEL and SPECIAL IRON CASTINGS

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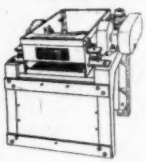
Note the small area occupied by the base of the "Polford" Core Sand Mixer. It is self-contained, the motor being built into the machine. With liquid Core Compounds, a batch may be mixed in 1½–2 minutes, and this unit will mix all Core Compounds, including semi-solids. Simple in design, fitted with screen for riddling sand as it is fed. Operates efficiently with minimum of friction. Low upkeep.



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This Machine has proved excellent for mixing facing sands.

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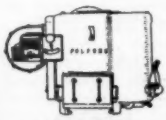
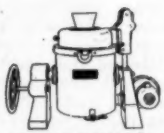


FORTABLE MOULD DRYER



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COMPANY RESULTS

(Figures for previous year in brackets)

Hammond Lane Foundry—Profit for 1943, £13,829.

Blaenavon Company—Profit for 1942, £21,437 (£13,657); depreciation, £12,000 (same); forward, £21,175 (£11,739).

Bertrams—Net profit for the year ended September 30, 1943, £13,480; to reserve, £7,500; employees' provident fund, £2,000; dividend of 10%; forward, £4,292 (£2,562).

Heenan, Beudow & Sturmey—Trading profit for the year ended November 30, 1943, after provision for E.P.T. and income-tax, £14,440; depreciation, £4,392; dividend of 15%; forward, £18,040 (£13,309).

Vickers—Final dividends of 2½%, actual, less tax, on the preferred 5% stock, 2½%, actual, less tax, on the 5% preference stock, and 2½%, actual, free of tax up to 6s. in the £, on the cumulative preference stock, making in each case 5% for 1943.

Kitchen & Wade—Net profit for the year to March 31 last, £118,610 (£92,231); trading profit of subsidiary company, Ormerod Shapers, Limited, £18,189 (£21,501); ordinary distribution, including a 5% bonus, 30% (same); forward, £5,000 (£4,422).

Clyde Crane & Booth—Net profit to November 30 last, £27,211 (£29,711); dividend on redeemable preference shares, £5,027 (£5,090); share redemption, £1,257; ordinary dividend of 15% (same); written off patents, £1,733; taxation reserve, £2,000; general reserve, £4,000; forward, £11,053 (£11,360).

Clarke, Chapman & Company—Profit for 1943, after tax, etc., £122,448 (£122,239); depreciation, £23,651 (£20,876); net profit, £96,038 (£98,605); 7% preference dividend, £4,890 (same); ordinary dividend of 12½% (same), £60,000; staff pensions, £10,000 (same); to general reserve, £20,000 (same); forward, £38,903 (£37,038).

Samuel Marsden & Son—Trading profit for year to July 31 last, after depreciation, £13,123 (£16,129); appreciation on investments, realisation and profit on debenture redemption, £2,269; debenture interest, £1,700 (£1,689); tax, £6,294 (£7,819); written off goodwill, nil (£2,999); preference dividend for 1½ years to June 30, 1938, £3,547 (same); forward, £29,033 (£27,802).

Mather & Platt—Profit for 1943, £435,970; depreciation, £45,731; income-tax and E.P.T., £190,000; deferred repairs, £17,320; War Damage Act, £4,531; written off shares in subsidiary companies, £10,000; net profit, £168,388 (£171,545); ordinary dividend of 10% (same) and preference dividend of 5%, £156,366 (same); forward, £99,758 (£89,736). Dividends are payable less income-tax at 9s. 2d. in the £.

Round Oak Steel Works—Profit for the year ended June 30, 1943, after depreciation and debenture stock interest, and crediting £48,605 attributable to the trading of former years, £146,539 (£99,759); tax, £80,000 (£55,000); war damage contributions and premiums, £2,087 (£4,000); dividend, less tax, on the 6% preference stock, £3,000 (same); to war contingencies reserve, £10,000 (£20,000); to general reserve, £30,000 (nil); dividend of 6% (3%), less tax, on the ordinary stock, £15,000 (£7,500); forward, £36,610 (£30,158).

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

558,202 ANGLO-IRANIAN OIL COMPANY, LIMITED, FAWCETT, E. W. M., and RICHES, T. W. J. Uniting of metal to, and sealing metal into vitreous and ceramic materials by heat.

558,221 HYDRO-BLAST CORPORATION. Method of sand-blasting and sand-blast device.

558,230 HOWDEN & COMPANY, LIMITED, J., and NELSON, W. Forced draught systems for boiler furnaces.

558,232 WANDSWORTH ELECTRICAL MANUFACTURING COMPANY, LIMITED, and BATCHELOR, T. Electric plug-and-socket couplings.

558,240 CARTER, F. S. Float operated valves for use in steam traps and like purposes.

558,242 HIRST, T. E. C. Power-transmission flexible coupling.

558,249 CRUISE, A. J. Air heaters or coolers.

558,289 CUMMING & COMPANY, LIMITED, W., and CAYZER, J. R. Ventilators for crucible and like furnaces.

558,319 CARLING, E. C. Couplings for flexible hose.

558,347 HOUSE, A. E. Welding methods and apparatus therefor.

558,353 HOLLAND, L. G. Boiler and like furnaces.

558,355 KAPELLA, LIMITED, and REASON, R. E. Apparatus for measuring or indicating roughnesses or undulations of a surface.

558,362 STONE & COMPANY, LIMITED, J., GOSSLING, S. F., HODGES, E. F., and MURPHY, A. J. Moulds for casting metal billets and the like.

558,375 HOFFMANN MANUFACTURING COMPANY, LIMITED. Seals for anti-friction bearings.

558,378 TATE OF LEEDS, LIMITED, and WADDINGTON, S. Sheet metal working machines.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

H.O.H. Metalcrafters, 1, Laurence Pountney Hill, London, E.C.4—£1,000.

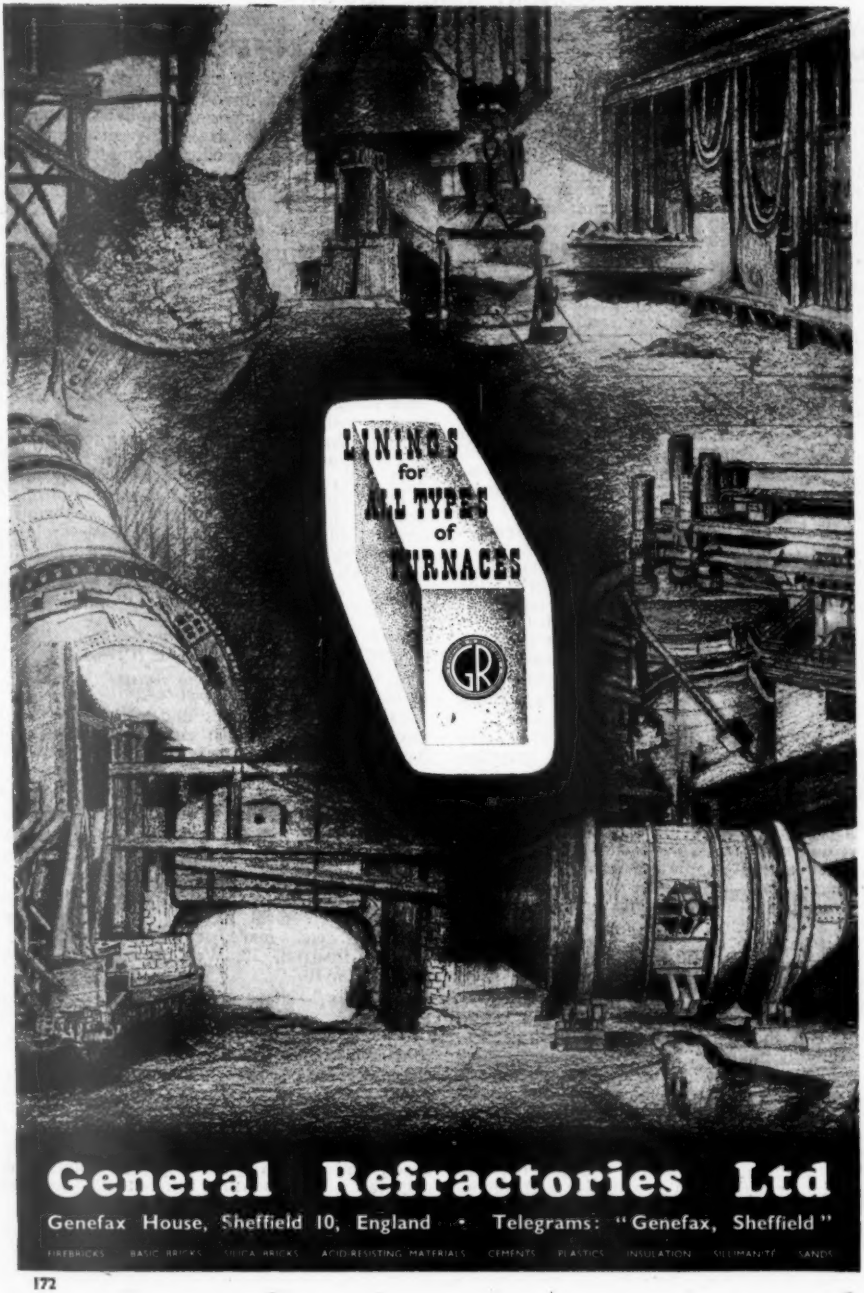
Ellis Metal Processes, 15, Wheatley Terrace, Erith, Kent—£1,000. R. and G. J. Ellis.

Arcwright Welding Company, Dockside Works, Dock Road, Tilbury—£100. D. McLardy.

Ensign Arc Welding Company, 25, Gowers Crescent, Baglan, Port Talbot, Glam—£2,000. T. J. Thomas and F. J. Wilde.

Paulton Agricultural Engineering Company, The Forge, Paulton, near Bristol—£500. R. E. E. and H. A. Trout.

H. W. B. Engineering Company (Darlaston), Stafford Road, Darlaston, Staffs—£1,500. J. Sambrook, F. Ridley and S. Horne.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172

Raw Material Markets

IRON AND STEEL

Although producers are not working under the intense strains which marked the earlier stages of Britain's re-armament, the pulse of the steel industry is beating with a fairly steady rhythm, and outputs are still almost exclusively directed into war channels. With transport conditions a little more favourable, production is being more promptly cleared.

Conditions in the pig-iron trade are fairly easy. Basic-iron production is carefully regulated in accordance with steelmakers' requirements, and consumption of foundry grades has been reduced, owing to the slackness in the light-castings and jobbing foundries. Heavy engineering and speciality foundries, on the other hand, are still handling a lot of Government work, and account for a fairly sustained demand for foundry and low-phosphorus grades. Orders for refined iron can be executed at reasonably short notice, but the scarcity of hematite persists, and there is no early prospect of a relaxation of the severe restrictions which have been imposed by the Control.

Supplies of foundry coke are coming through a little more freely, but there are still delays en route, and establishments which managed to accumulate reserves last summer and autumn are now feeling the benefit of them. Foundries lacking stocking accommodation at times experience some inconvenience. The blast furnaces are getting sufficient coke to maintain full production. Cast-iron scrap is by no means plentiful, but foundries generally manage to secure their requirements. Pig-iron is available to make good any real shortage of scrap.

Re-rollers have reason to be grateful for the recent release of fairly considerable tonnages of imported semis. Supplies of home-produced billets, etc., have been coming to hand somewhat irregularly of late, and stocks of American material have proved a useful stand-by. Deficiencies in deliveries are mainly due to transport difficulties. As trucks are provided steelmakers are well able to supply the weekly allocations, but recent experiences emphasise the desirability of having reserve stocks in hand for emergency use. There is still a good demand for defective billets, but defective sheet bars are less easily cleared. Shell-discard steel is sometimes available and is readily accepted by re-rolling establishments.

The proportion of finished steel now provided in the form of heavy joists and sections is much below normal, but with this exception all the steel departments are fully occupied, and rollers of plates and light and medium sections are so heavily booked up to the end of June that additional orders must be of the greatest urgency to have any hope of acceptance. Shipbuilders' requirements are accorded special prominence in the programmes of both the plate and sheet mills, and there are also the pressing requirements of the boiler makers and locomotive and wagon shops which command attention.

NON-FERROUS METALS

The question of copper supplies has been raised in the House of Commons recently. It seems that the effects of the curtailment of Rhodesian production will not materially alter the supply situation, as far as this country is concerned, for some considerable time. Probably, there will be no great change in the position before next autumn. There has been no word of further cutting down of production, but it would not be surprising if other copper-producing areas were called upon to reduce their output. In Rhodesia it is likely that large stocks have been accumulated, awaiting shipment, and the disposal of these will maintain a flow of supplies to consumers in this country and elsewhere on the old scale for some time to come.

The supply of non-ferrous metals is still going mainly into munitions production. Reports from America indicate that a fair amount of domestic work is being undertaken. Some manufacturers in this country are finding themselves running short of wartime orders, but the Control are still reluctant to relax their restrictions on the use of metals for ordinary commercial work, although the supply position is now understood to be far from unfavourable. The amount of domestic work in hand at the moment is negligible, but a certain amount of zinc is being released for galvanising purposes, and the range of articles for which this is permitted may be extended.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"ENCOGEN"—Furnaces and plant for use in the heat-treatment of metals; gas generating plant. WILD-BARFIELD ELECTRIC FURNACES, LIMITED, Watford.

"NICROTECTILE"—Plates of nickel chrome steel, parts of furnaces. INCANDESCENT HEAT COMPANY, LIMITED, British Mills, Cornwall Road, Smethwick.

"ACE" (and device)—Cranes, hoists, power shovels, and earth-working machines. A.C.E. MACHINERY, LIMITED, Harlequin Avenue, Great West Road, Brentford, Middlesex.

"BARMIT"—Grill flooring, platforms, stairways, hand-rails, etc., made of common metal. GRILL FLOORS, LIMITED, 22, West Row, North Kensington, London, W.10.

"FEN-FIX"—Plate or bracket devices of common metal for use with fencing. BRENTFORD TIMBER COMPANY, LIMITED, 37 & 39, Kew Bridge Road, Brentford, Middlesex.

"MAXOGRIP"—Pipe junctions of common metal. T. C. ENSTONE & COMPANY (SUCCESSORS), LIMITED, Pyramid Engineering Works, Evelyn Road, Greet, Birmingham, 11.

"HIDU"—Mouldable materials for industrial purposes, and adhesives for bonding metals and other materials. HIDUMINIUM ENGINEERING, LIMITED, 115, Buckingham Avenue, Slough.